Playing to Wait: A Taxonomy of Idle Games

Sultan A. Alharthi[1], Olaa Alsaedi[1], Zachary O. Toups[1], Joshua Tanenbaum[2], Jessica Hammer[3]
[1]Play & Interactive Experiences for Learning Lab, New Mexico State University, Las Cruces, NM, USA
[2] Transformative Play Lab, Department of Informatics, University of California, Irvine, CA, USA
[3]HCI Institute / Entertainment Technology Center, Carnegie Mellon University, Pittsburgh, PA, USA
{salharth, olaa}@nmsu.edu, z@cs.nmsu.edu, joshua.tanenbaum@uci.edu, hammerj@andrew.cmu.edu

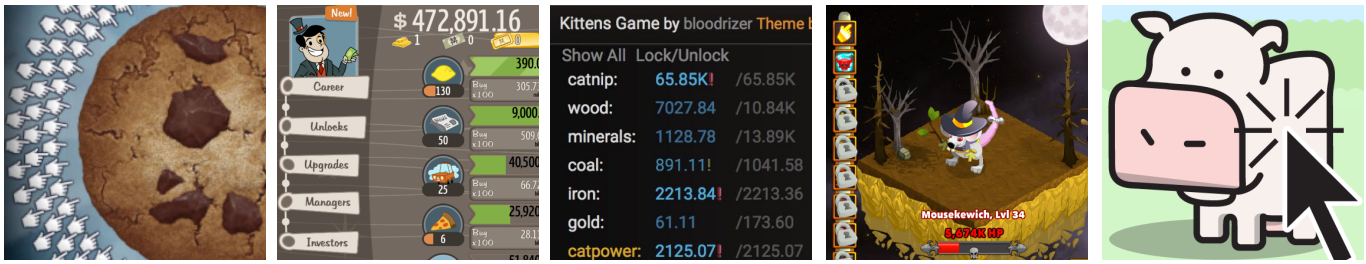

Figure 1. Sample of idle games featuring different styles of gameplay, interaction, and graphical or text interfaces. From left to right: *Cookie Clicker* [G50], *AdVenture Capitalist* [G38], *Kittens Game* [G16], *Clicker Heroes* [G66], and *Cow Clicker* [G39]. Screenshots taken ⓒⓘ author Alharthi.

ABSTRACT
Idle games are a recent minimalist gaming phenomenon in which the game is left running with little player interaction. We deepen understanding of idle games and their characteristics by developing a taxonomy and identifying game features. This paper examines 66 idle games using a grounded theory approach to analyze play, game mechanics, rewards, interactivity, progress rate, and user interface. To establish a clearly bounded definition of idle games, we analyzed 10 non-idle games with the same approach. We discuss how idle games move players from playing to planning, how they question dominant assumptions about gameplay, and their unusual use of resources such as player attention and computer cycles. Our work illuminates opportunities for the design of idle games, suggests design implications, and provides a framework for researchers to clearly articulate questions about this genre.

ACM Classification Keywords
H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords
Idle games; clicker games; incremental games; taxonomy; playing; waiting; planning; game design; grounded theory.

INTRODUCTION
Idle games are a minimalist gaming phenomenon that have gained popularity in recent years [34, 37, 60]. These games are typically played in web browsers, on mobile devices, or on a PC. Players progress with minimal-to-no interaction. Idle games usually involve repeating a simple action (e.g., clicking, rubbing, tapping) to accumulate resources as a *core mechanic*, an action that is regularly performed in play [55]. Most idle games also include mechanics that automate gameplay so the game progresses by itself [50]. Although the interactions are simple, players find these games rewarding [28, 37].

Comparing games or connecting them to a genre is among the most common ways to describe games [20, 36]. However, the choice of features on which to compare games is key. For example, one might connect *Cookie Clicker* [G50] and *Cow Clicker* [G39] because they are controlled with nothing but a click. On the other hand, *Cow Clicker* allows the player to click once every six hours, while in *Cookie Clicker*, the player can click at any time and is encouraged to do so frequently. If we look at the core interaction, the games appear similar; if we analyze them temporally, they are different.

Existing taxonomies of game genres define relationships [1, 4, 20, 43, 53, 67]. However, these taxonomies typically focus on player interaction and choice. Unlike most other digital games, idle games are primarily played by *not playing*. Existing taxonomies of digital games are therefore unlikely to help discover the salient features of idle games.

We cannot rely on prior definitions from the community of designers and players to help disambiguate the features of idle games, as many terms are used interchangeably. Idle games as a genre are also referred to as *ambient*, *incremental*, *clicker*, and *background* games. These terms are used by designers, gaming platforms, and players to signify differences between idle games, particularly as the popularity and number of these games has increased dramatically [34]. However, there is no agreement in the gaming community about what

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key differences are indicated by these terms. Although a small number of research papers address "idle games" [18, 50], a growing corpus uses other terms [7, 9, 21, 37, 70].

We therefore propose the following research questions:

RQ1: What are the essential features of idle games?

RQ2: How do these features cluster to produce different game types?

RQ3: What are the design implications of each type?

In answering these questions and developing design implications, we aim to support researchers and designers in creating, using, and analyzing data from idle games. The lack of precision in describing and classifying idle games makes it challenging for researchers to make progress understanding them, and for designers to explore new approaches to the genre. Taxonomic work, such as Mueller et al.'s work on exertion games [43], facilitates both of these activities.

We expect the taxonomy to support designers (and researchers-*cum*-designers). As idle games rise in popularity, there is value in considering not just designing them in isolation, but also as synergistic to other "standard" games and gamified systems, where they could supplement play in the long term. We also argue for responsible and sustainable approaches to the design of these games.

To answer the research questions, we analyze existing idle games through grounded theory. We choose to analyze games as our main source of data because there is relatively little literature that addresses idle games (e.g., [18, 37, 50]). Expert analysis of games as artifacts is likely to be most revealing.

We start by reviewing the history of idle games and other background. We describe our methodology for selecting, observing, and analyzing idle games through grounded theory. In our results, we present a taxonomy of idle games, define each category, and present an interactivity spectrum for idle games. We close with discussion and design implications.

In the present research, we provide a ludography for the games considered as part of our dataset. When we cite a game, it is prefixed with a "G" (e.g., [G16]).

BACKGROUND

We open with a history of idle games. We then discuss prior video game taxonomies and identify how they fall short for idle games. A section on game design establishes terminology for the remainder of the paper.

History of Idle Games

Idle games can progress with minimal or no player interaction [18,34,37,50]. Many of these games involve repetitive clicking or tapping to accumulate resources and the ability to automate gameplay [48, 50, 60].

A precursor to idle games are *bots* (i.e., *AI agents*): automated computer players that act as if controlled by a human [40, 69]. *Angband* [G2], one of many *Rogue*-like games that involve playing through a procedurally generated adventure, is designed for human players, but can accommodate a bot, like *Angband* Borg [15]. Borg can control the game and progress without the player [69]. Bots are not limited to single-player games. In *World of Warcraft* [8], farming bots help the player automate resource collection (e.g., TheNoobBot [62]).

In 2002, *Progress Quest* [G25] became one of the first games specifically designed to be played non-interactively. In *Progress Quest*, the player defines a fantasy avatar, then watches as the game plays itself, describing how the avatar advances over time. Similar games, with which the player only interacts during a setup phase, include *Conway's Game of Life* [G47] and *Godville* [G31].

Ambient Quest [G58], in 2006, integrated concepts from *Progress Quest* with pervasive play [21]. Pedometer data was used to control avatars in a digital game. While the designers had intended the game to use data generated by players' ordinary activities, with no special game-based interaction, they found that players changed their behavior because of the game (e.g., cheating by shaking the pedometers [21]).

In 2010, Bogost released *Cow Clicker* [G39] as a satire of then-prevalent social media games that used waiting to incentivize players to get help from friends [9]. *Cow Clicker* gave the player a point each time they clicked a cartoon cow, limited to one click every six hours. The game was a hit, despite Bogost's intent to reveal the ridiculousness of the mechanics [9].

Cookie Clicker [G50], which integrated features of *Progress Quest* and *Cow Clicker*, gained instant popularity in 2013 and pushed the genre into the mainstream [70]. *Cookie Clicker* offers a smoothly animated, highly graphical interface: the player starts clicking on a cookie image to "bake cookies" at the rate of one cookie per click, which are used to buy characters and buildings that increase the automatic cookie production rate. However, text-based games such as *Kittens* [G16] and *Candy Box !* [G5] demonstrate that polished graphics are not necessary for the continued development of the form.

As of this writing, idle games have moved from curiosities and parodies into a healthy and growing genre [18]. For example, *Clicker Heroes* gained instant popularity, reaching Steam's top ten most played games in 2015. While idle games began on PCs and were driven by mouse clicks, a number of well-known idle games have mobile versions and use tapping as a core interaction (e.g., *Cookie Clicker* [G50], *Clicker Heroes* [G66]).

Video Game Taxonomies

One method for organizing knowledge about video games is through creating taxonomies. This method presents an ordered classification, based on common properties, in which games are categorized according to genres and sub-genres [20, 44, 67].

One of the first digital game taxonomies was developed by Crawford [16], which was influenced by Caillois's taxonomy of *play form* for physical games [12]. He divided games into two main categories: *skill-and-action* games, which emphasize perceptual and motor skills, and *strategy games*, which emphasize cognitive efforts. These categories are broken down to describe groups of games with different characteristics.

Since then, a number of taxonomies have been proposed to categorize games based on gameplay and interaction [1, 4, 43];

types of challenge [53]; and narrative, aesthetics, and mood [20]. These taxonomies enable researchers and developers to have a clear understanding and an overview of each genre, its expectations, and interface designs that work well.

Challenges in Identifying Idle Games

Purkiss and Khaliq define idle games as games that support "leaving the game running by itself for long periods of time" [50, p1]. The authors propose that the terms *incremental*, *ambient*, or *clicker* games refer to the same game type, while *zero-player games* are a sub-type of idle games.

An examination of how these terms are used by other authors suggests that these terms are, in fact, not identical, nor used identically by other researchers. Deterding uses *idle* and *incremental* interchangeably [18], while industry researchers Quantic Foundry use the terms *idle* and *clicker*, but not *incremental*, when describing the same set of games [70]. However, *clicker* is sometimes treated as independent of *idle* and can be used as a separate descriptor of genre [9, 28]. Adding to the confusion, the term "clicker games" is also used for games involving classroom clickers, which are small devices used by students to interact in classrooms, especially to answer quizzes, in real time [10].

Zero-player games are formally defined as games "for which no human involvement is required" [7]. The authors define four subtypes of zero-player games, including games where the player intervenes only during setup (e.g. *Progress Quest* [G25]) and games that fully play themselves.

Ambient games, whose name is derived from ambient music, reduce player interaction by remaining in the background while the player does other things [21]. In these games, the player can easily switch between the game as a background activity, which occupies the peripheral attention of the player, and another task which is occupying most of their focus.

Finally, *background games* are defined as games "where the majority of the work happens while the player is not playing" [37]. Keogh and Richardson discuss how social and background games are ambient in nature: they embed themselves within the player's everyday life [37]. The authors argue that "background" and "idle" games are used interchangeably to account for the phenomenon of *waiting as playing*.

As an illustration of the confusion generated by these multiple terms, consider the case of *Cow Clicker*. Is it the first clicker game? An idle game and a clicker game? An idle game and an incremental game? Does it remain in the background such that it is played ambiently? Perhaps the only thing the state of the field allows us to confidently state is that *Cow Clicker* is not a zero-player game, as it allows the player to interact with a click every six hours. It is this uncertainty we seek to resolve with our present work.

Game Design

Prior game taxonomies are constructed through deep investigations of game mechanics, gameplay, and interfaces. Salen and Zimmerman [55] characterize games as interconnected systems of *rules* and *play*. Rules are the boundaries that constrain player action: logical and mathematical structures of the game. Play is the freedom to make decisions within the rules. *Game mechanics* are the designed choices a player makes, resulting in an observable outcome [2, 55]. Mechanics that are repeatedly invoked, and that affect the underlying subsystems of the game in important ways, are the *core mechanics*. For example, idle games are characterized by core mechanics of *clicking* to generate or spend resources, and *waiting* for the right time to act [50].

As this example suggests, game mechanics often affect *resources*. Resources are elements that are controlled by, and can be manipulated by, a player [57]. Resources can be acquired or lost, either through player action or for reasons outside of the player's control. They can also typically be used to manipulate other parts of the game directly or indirectly.

Managing resource accumulation and spending is a critical part of *game balance*. If resources are accumulated faster than they are spent, the player will never experience scarcity or need to make difficult decisions about how to use limited resources. If the player can never earn enough resources to influence the game, they will not be able to interact with it successfully. Balancing resource production rates and costs is a critical element of idle games [48].

One of the most important aspects of any game experience is player interaction [17]. As we will see in this paper, the level of player interaction in idle games varies greatly [7, 50].

METHODOLOGY

We conducted a qualitative study on idle games to identify the characteristics of their gameplay, mechanics, and interfaces. We employed a grounded theory approach [23–25], starting with an iterative process of finding and selecting idle games, then performing open coding to identify the initial concepts and categories of idle games and their associated features.

Salen and Zimmerman [56] suggest that one of the best ways to understand a game is to play it, so the researchers engaged in multiple play sessions for each game to deeply analyze idle games. Examining games from within helped gain an understanding of their gameplay, mechanics, and interactivity. This approach has previously been applied to exertion games by Bianchi-Berthouze [6] who used it to present a taxonomy of classes of body movements observed during game play.

Grounded theory is a set of practices that are used to explore a new domain [23–25] by iteratively collecting data, analyzing it, connecting with literature, and reporting findings [31]. Grounded theory begins with an iterative process of data gathering and analysis. *Open coding* involves applying labels to the collected data to identify what is different or unique about it to form the initial concepts. Preliminary open coding develops insights about the studied phenomenon and benefits the next round of collection and analysis [24]. *Concepts* are created by identifying and grouping codes that relate to a common theme [3]. *Axial coding* is performed by identifying relationships among the open codes and initial concepts, which results in the initial categories. *Selective coding* integrates the categories to form a core category that describe the data. Through this iterative process, a theory emerges that describes the data and can be applied to new data.

Source (Count)	Categories		
Kongregate (28)	Idle	Clicker	Incremental
	[G15,G17,G19,G23,G30,G37,G51,G56,G70,G74]	[G10,G11,G34,G35,G38,G65,G66,G69,G72, G73]	[G12, G13, G26, G32, G40, G52,G67,G75]
Almost Idle (24)	Idler	Clicker	Civ Builder
	[G20,G22,G28,G29,G33,G46,G48,G54,G55,G71]	[G3,G4,G7,G14,G27,G43,G57,G60,G61,G63]	[G16,G21,G36,G45]
Additional Games (14)			
	[G2,G5,G6,G8,G9,G25,G31,G39,G47,G49,G50,G53,G58,G59]		
Non-Idle Games (10)			
	[G1,G18,G24,G41,G42,G44,G62,G64,G68,G76]		

Table 1. The list of the selected idle games from Kongregate and Almost Idle, categorized based on how the game was identified on the source website. Categories are not mutually exclusive, meaning one game can belong to multiple categories. Additional games are also included in this list, which are selected based on prior research and authors' experience. Non-idle games are included in this lest of games and not categorized.

Our iterative process started with selecting game portals and retrieving idle games (Figure 2). Two researchers, independently, played all the retrieved games and recorded their observations, while two other members of the research team played a subset of the games to better understand the space and comment on observations. Based on the researchers observations, open coding was performed to identify the main features of each game. Axial coding was then conducted, followed by selective coding, which led to the final categories.

Search Strategy

To maximize our corpus of games, we searched two popular web gaming portals to find and retrieve games: Kongregate and Almost Idle. We used the websites' existing categories to collect a set of different types of idle games. Using existing classifications of idle games from both websites helped us narrow down game selections to ones that fit the targeted genre. We focused on the most popular games on both websites. This criteria helped us to select games that are considered relevant and valuable by the community (Table 1).

Kongregate is a portal and social network site for web-based games and includes a number of idle games in its catalog. It provides a database of playable games with attached metadata that include game name, developer, description, category, rank based on reviews, number of plays, and year of release. Kongregate also provides social networking features for its members and achievements for its games [32,65]. Almost Idle provides a community-driven catalog of incremental, idle, and clicker games. It provides a more specific emphasis on idle games compared to Kongregate. The search process resulted in a total of 118 games. In the following, we describe the search strategy for each game portal in detail.

On Kongregate, we examined all official categories in the catalog and identified three that were relevant: idle, clicker, and incremental games. Within each category, we sorted all the games based on number of plays to ensure that all the selected games were popular. We selected games starting from the top of each list, removing all games that were not playable (i.e., could not load or otherwise interact with) as well as duplicate entries in the selected list. We continued this process, eliminating 14 non-playable and 15 duplicate games. This process resulted in selecting a total of 28 games.

Almost Idle includes a variety of idle games in its catalog and provides a chart of the top games in the website, which we used to select games. We sorted games based on popularity, ensured games were playable, and removed duplicates. We

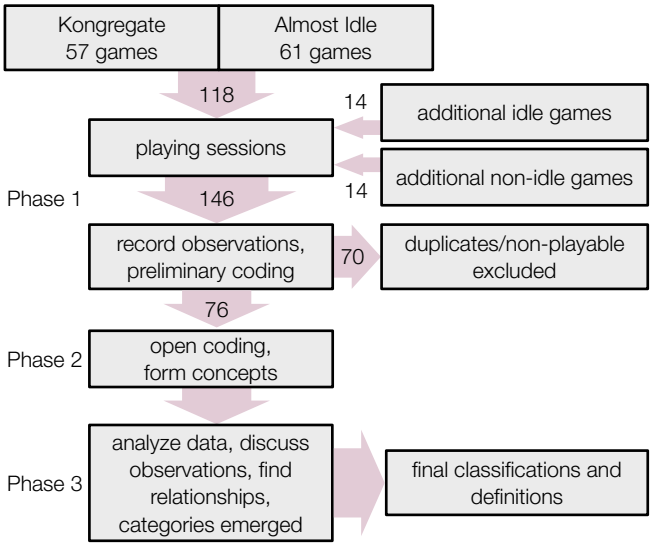

Figure 2. The digram showing the process of collecting, filtering, and analyzing games. Arrows are labeled by number of games in the corpus.

eliminated 37 games that were unplayable or redundant and selected 24 games. We then coded these 24 games based on the site's categories of idler, clicker, and civ builder games.

Additional Games and Prior Definitions

To ensure a comprehensive corpus, we added 14 well-known idle games that were described as idle in the literature, in references from other games, on social media, and the authors' experience. These games were not covered by the web gaming portals. Adding these 14 games ensured that we did not leave out games that can help understand this new phenomenon. Also, to understand and distinguish idle games from other games, we added 10 non-idle games. These non-idle games were selected from the top games in Kongregate after filtering them based on number of plays, and removing 4 idle games that was part of the top list. A total of 76 playable and unique games were included in the final analysis (Table 1).

Prior terms and definitions of idle games that were discussed in relevant literature and in the game community were identified and used as codes in the analysis process. Including these codes helped us to gain better understanding of idle games and to form new definitions and concepts. Some of these codes include: IDLE, ZERO-PLAYER, CLICKER, INCREMENTAL, MINIMALIST, and AMBIENT.

Game Feature	Observations
Game name	*AdVenture Capitalist* [G38]
Play description	You start CLICKING on a lemonade stand and collect money. Spend money to make upgrades, INCREASE PRODUCTION PER CLICK. Start hiring workers and INCREASE PRODUCTION PER SECOND. When you have enough money, you can buy new businesses, automate all your businesses to INCREMENT more money, and leave the game progress.
Game mechanics	Click to gain money, AUTOMATE production, make upgrades to DAMAGE/SEC.
Rewards	ONE CURRENCY, which is money, is rewarded in return.
Interface	GRAPHICAL
Interactivity level	7
Progress rate	9
Overview	This is a SINGLE-PLAYER game, which requires LONG CYCLES OF CLICKING at the start, and making a number of upgrades. Production rate reaches $390/sec in less that 10 minutes and you gain 1M in cash making the game progress faster.

Table 2. An example from our research process to illustrate phase 1 of the research, in which two authors played the games, recorded their observations, and performed preliminary open coding. Words that are in SMALL CAPS are identified by the author as codes.

Analysis Procedure

The analysis procedure involved three phases and is outlined on Figure 2. Phase 1 involved initial observations of game features; in Phase 2, we performed open coding on our initial observations of game features; and in Phase 3, we revised our coding scheme to develop axial codes.

Phase 1: Initial Observations of Game Features

The focus of this phase was to identify the main characteristics of each game. Each selected game was played by two researchers to record observations on gameplay, game mechanics, rewards, interactivity, progress rate, and game interface.

After recording observations, each researcher rated games on 11-point interactivity scale (0–10). Labeling a game with an interactivity level of 0 meant that the game would progress by itself without any interaction from the player. A rating of 10 meant that the game would slowly progress unless the player regularly returned to the game to ensure that play advances (Table 3). This method of rating was used by Purkiss and Khaliq to rank interactivity levels of idle games [50]. Additionally, using the same scale, we labeled each game based on the rate at which the game progresses. A rating of 10 meant that the game progressed quickly to advanced levels. Labeling a game with a progress rate of 0 meant that it progressed slowly (e.g *Cow Clicker* [G39]).

At the end of each play session and observation, each researcher recorded a brief overview of the game and conducted a preliminary open coding to label interesting and/or unique characteristics of the examined game. We provide an example from our research process to illustrate this phase on Table 2.

Game Name	Interactivity
Progress Quest	0
Casino Clicker	3
Crusaders of the Lost Idols	5
Candy Box 1	6
AdventureQuest Dragons	8
A Dark Room	9

Table 3. An example of some of the games from the dataset and their associated interactivity rank. Games with low interactivity rank requires less attention from the player for the game to advance, however, games with high rank progress slower without constant interaction.

Weighted Kappa Coefficient		
	Interactivity	Progress
Weighted Kappa	0.6968	0.7515
ASE	0.0774	0.0773
95% Lower Conf Limit	0.5450	0.6000
95% Upper Conf Limit	0.8486	0.9031

Table 4. Cohen's weighted kappa was run to determine the agreement between the two researchers on interactivity level and progress rate of the examined games.

The rating process for interactivity level and progress rate helped us establish inter-rater reliability [29]. We used weighted kappa statistics to evaluate the agreement between the researchers on interactivity level and progress rate of the games [14]. The results show a substantial agreement between the two researchers on both interactivity level ranking κw=0.696 and progress rate ranking κw=0.751 (Table 4).

Phase 2: Open Coding on Observations

ATLAS.ti Mac [5] was used to manage and code the data. The application allows any type of data to be coded and analyzed, including textual, graphical, audio, and video data. Each author's spreadsheet was imported into the application for line-by-line open coding of the observations. As we continued coding the data, we found similar concepts and reclassified them under common categories.

When all data have been coded, part of the data can be selected to display which codes have been assigned to them. Through this process, concepts can be explored and linked to create new categories. For instance, the code INCREASE DAMAGE PER CLICK was used when a game features a mechanic where the player can perform an upgrade that causes each click to damage an opponent more. This code is used on 25 games in the data set.

Phase 3: Axial and Selective Coding

During this phase, the researchers engaged in multiple iterative discussion sessions to explore the relationship between the codes, the emergent concepts, and the initial categories. While constructing the categories and finding relationships between them, we re-observed some of the games, and reviewed related literature to refine the concepts. The result of this phase is a set of categories and subcategories of idle games (Figure 3). In this research, we are interested in finding the interrelationship between the categories of idle games.

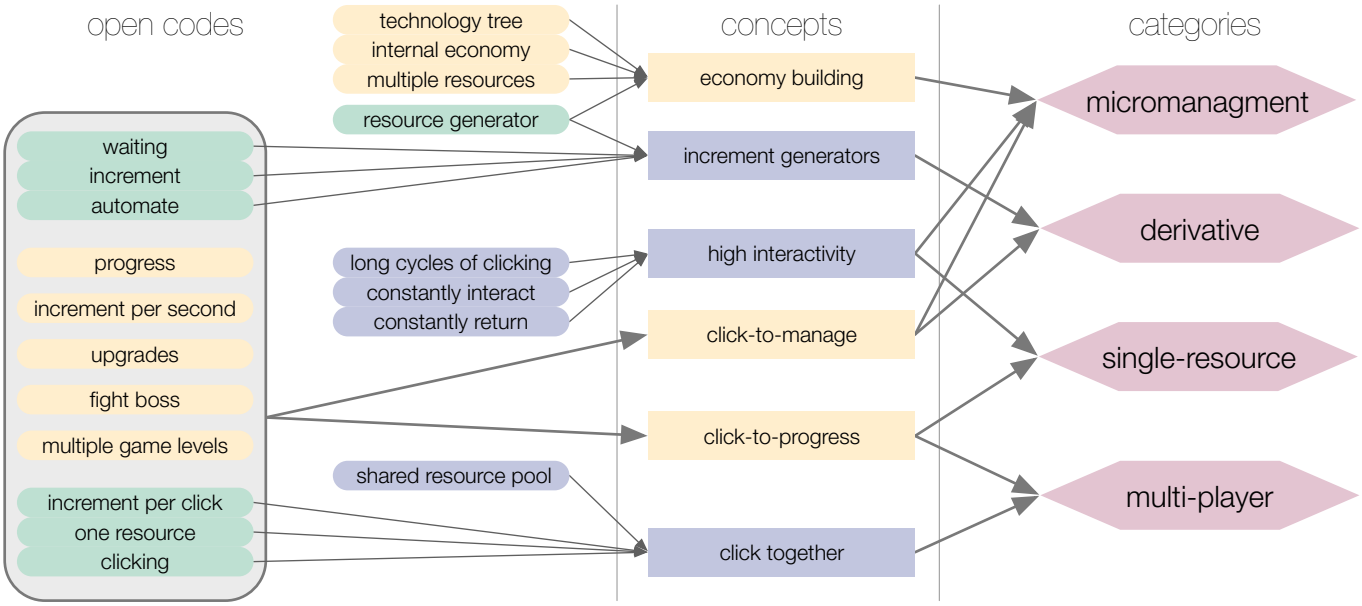

Figure 3. The analysis process that developed the incremental games super-category (each category above is part of incremental games). The process started with open coding of observations on idle games: multiple codes are created. Concepts are discovered through analyzing the open codes and identifying common features. This is an iterative process, where new codes are added, combined, or deleted. Each code is connected to one or more games and can be combined to form new concepts. Concepts are analyzed to find common relationships, and, thus, categories emerge. In the diagram, coloration is only to aid in reading. The left grouping is to show that all contained codes are part of click-to-manage and click-to-progress.

TAXONOMY OF IDLE GAMES

Based on common features and the concepts that emerged, our taxonomy defines the key characteristics of idle games in two ways. First, we define idle games based on key features, as well as several distinct *subcategories* of idle games. Second, we identify an *interactivity spectrum* for idle games, which can be applied to games in any category.

Idle Games (Id)

Idle games are games that can progress without player interaction for some period of time (e.g., [G16, G25, G50]). The majority of the play in idle games takes place in the background while waiting, thus idle games can be also identified as *background games* and *ambient games*. Non-idle games however, require players to interact with the game to progress. These games rarely can progress without interaction (e.g., [G42, G62, G64]).

By comparing idle games to the 10 non-idle games in our sample, we developed a fuller set of criteria that helps classify a game as idle. All following features need to apply to the game for it to be classified as idle:

- the majority of the play happens in the *background*;
- in these games *waiting is playing*—the game can progress while the player is not present, often through mechanics that *automate gameplay*;
- features *temporal flexibility*—players have the flexibility to set aside the game until they are ready to return to it, with minor or no penalty for not returning [37];
- often one instance of the game is *played consistently* over one or more years; and
- features *no game over* condition.

Many social games, especially those that feature micromanagement play (e.g., *FarmVille* [71]), share some of these features. Given that *Cow Clicker* [G39] was designed as a direct critique of this game genre, that is unsurprising. However, social games are deployed on social networks such as Facebook, and typically use the *threat* of idling to incentivize social interaction with other players. Idle games are more typically web- or app-based, and idling is treated as a *feature* rather than a bug. Further, unlike idle games, social games do carry a penalty for players to wait too long: players must check in at specified intervals or lose progress.

Idle games do not incorporate game over or death conditions, which means that players can keep playing the same instance of the game for as long as desired. However, many idle games incorporate a New Game+ (NG+) mechanic [22] (e.g., [G16, G21]). NG+ mechanics let the player reset progress in the game, erasing all current resources and accomplishments in exchange for bonuses in a future playthrough.

Incremental Games (Inc)

We define *incremental games* as idle games in which a player selects resources to generate, waits for resources to accumulate, then spends resources to automate part or all of the resource generation process. Resources *accumulate* in this type of games as long as the game is left running (e.g., [G5, G16, G21, G33]). They are deceptively simple at first, but reveal impressive depths, including finely tuned reward curves, bottlenecks, plateaus, and economic models.

Incremental games commonly feature an internal economy. *Economies* are systems in which resources are produced, consumed, allocated, and/or traded . Internal game economies

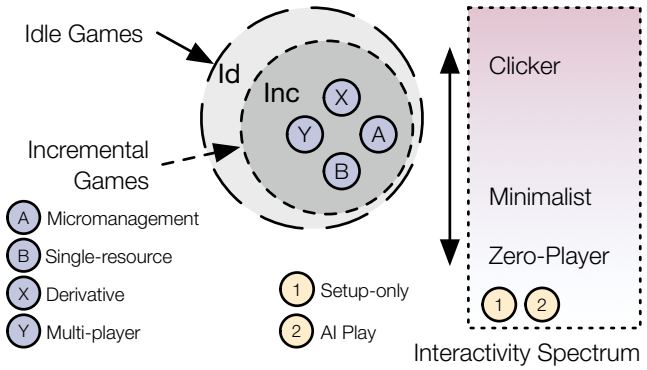

Figure 4. Idle games classification and interactivity spectrum. This graph shows the interrelationship between the sub-categories of idle games and levels of interactivity. Games (in general) are the superset that includes idle games (Id) as a subset. Idle games are a superset for Incremental games (Inc), which includes four categories (A, B, X, Y). The interactivity spectrum ranges from clicker to zero-player.

are systems that manipulate resources through sources (to produce resources), drains (to remove resources), converters (to change a resource type), and traders (to move resources among players) [2]. Incremental games revolve around building an economy in order to progress, and around accumulating the resources needed to do so.

Incremental games have a tendency to feature positive rates of change, which facilitates them being left idle for extended period of time. They are different from simulation games (e.g., *SimCity 4* [41]), which are outside the scope of this work, in that they rarely feature random negative events, and often they can be set into a state where all resources monotonically accumulate [16, 45]. A number of sub-genres of incremental games emerged from the analysis:

- *Micromanagement games* (A): involve multiple resources that the player uses to build an internal economy. Micromanagement games feature high interactivity levels, mostly textual interfaces, and an NG+ mechanic. The level of progress in this type of games is generally slow. In micromanagement games, the player is afforded more options and can make more decisions to progress in the game, with multiple advancement vectors. (e.g., [G16, G21]).
- *Single-resource games* (B): provide the player with only one resource, which they produce and spend to complete upgrades in order to progress in the game. Interactivity level in these games is generally high, and they feature a higher progress rate compared to other idle games. Most of these games feature a stable gameplay pattern, where the player is afforded a small number of actions to perform in the game in order to progress (e.g., [G50, G66]).
- *Derivative*[1] *games* (X): involve single or multiple resources with which the player can build resource generators to automate the production of the main resource of the game. This type of game features a unique game mechanic that allows the player to build generators that produce other generators, but all of them contribute to the production of the main resource (e.g., [G33, G72]) [49].
- *Multi-player incremental games* (Y): allow multiple players to accumulate a resource simultaneously by clicking and/or automating production, and the accumulated resources are shared (e.g., [G40, G63]).

[1] "Of, pertaining to, or designating a control element whose output is a linear function of the derivative (the rate of change) of its input." [46]

INTERACTIVITY SPECTRUM

Interactivity in idle games range from games that require constant interaction to no interaction at all. Interactivity in idle games can be interpreted not in terms of exclusive categories, but as *degrees* of interactivity along a spectrum, from games that require no interaction other than starting the game to those that require periodic player involvement. While some idle games sit at a consistent point on the spectrum, a more typical pattern is for different phases of each game to invite different levels of interaction. We identify three common patterns.

Clicker

At the higher-interaction end of the spectrum are *clicker* games. These games that involve *clicking, rubbing, or tapping as a core mechanic*; damage is caused and/or resources are generated by multiple clicking cycles on an object, which are separated by waiting periods. Some clicker games begin with extended clicking episodes to collect a resource or unlock an upgrade (e.g., [G10, G14, G38, G66]). However, these clicking episodes usually fade out after progressing further in the game. In other games, the player must continue to click rapidly and regularly to progress, even though the game advances while idle (e.g., [G10, G38, G66]). Clicking may also be interspersed with long periods of waiting (e.g *Cow Clicker* [G39], which allows one click every six hours), moving the game toward a more minimalist experience.

Minimalist

Minimalist games reduce the number of available actions to a small subset of options, either through game mechanics that automate gameplay or gameplay phases that reduce the player interaction (e.g., bottlenecks, plateaus) [48]. These games may contain zero-player passages [7], effectively sliding to the bottom of the continuum, or the player may engage in production on a small scale (e.g., [G9, G70]).

Zero-Player

At the other side of the spectrum are *zero-player* games. These games require no player involvement after starting or allow limited input during setup but no influence in gameplay [7]. These games are *ambient* in nature, due to the limited interactivity and the ability to leave them open in background, ready for the player to attend to anytime. While Björk and Juul [7] defined and categorized zero-player games, we include zero-player as a degree in the interactivity spectrum with two phases:

- *Setup-only* (1): allow a player to interact with the game only once at the start of the game, then the game play itself without further involvement from the player (e.g., [G25, G49, G53]).
- *AI Play* (2): all progress in the game is controlled solely by the game AI (e.g., [G2]).

DISCUSSION AND DESIGN IMPLICATIONS

We have investigated the features of idle games to develop a better understanding of the distinct gameplay categories in this space. Our taxonomy shows that this new game genre can appropriately be defined to enhance our understanding of this new phenomenon. We showed that not all idle games are the same, each category has a set of unique and identifiable features. In this section, we provide design implications for supporting design, development, and further research within the space of idle games.

Interestingly, we found that our taxonomy was based more around game *rules* than mechanics. That is, the taxonomy considers the underlying mathematic structures of the games, the ways that they drive players to certain states, rather than thinking about interactivity or interaction strategies. We expect that this is due largely to our focus on games that are intended to be played minimally (or not at all); unlike other types of games, idle games are — by design — less focused on the choices players make, but how those choices unfold over time.

Why Idle Games Are Interesting

One of the main characteristics of idle games is a strong *support for playing less*. Idle games, in general, feature a balance between rules that encourage players to leave the game and rules that reward them for returning. Being able to leave the game in the background, without interacting with it, makes these games easy to interleave with daily activities [35, 37, 54].

Playful Idling

In these games, rule systems are explicitly designed to force players into an idle state, during which resources accumulate. Typically, every activity in the game costs resources; these resources take time to accumulate but can be spent quickly, in just a few clicks. The costs of actions also increase with each interaction. The more the player interacts with the game during a given session, the fewer options remain to them (e.g., [G16, G21, G50]). Conversely, the longer players go without interacting with the game, the more options they have when they return.

Idle games challenge Weiser and Brown's claim that "a calm videogame would get little use" [68]. *Calm technologies* are those that wait at the *periphery*, the edge of attention, and can be attended to at will [68]. Idle games do not merely wait at the periphery of a player's attention, but actively place themselves there. To attend overlong to an idle game is to play it poorly, with few opportunities for interaction. Additionally, idle games do not penalize the player by demanding attention. A player who idles for too long may forgo opportunities to acquire new resources, but typically does not place their existing successes at risk.

Rewarding Players for Waiting

In idle games, waiting is considered part of play. Waiting phases invite players to set play aside, providing time to think about future choices.

Unlike other games that include waiting mechanics, idle games center and value waiting. For example, *Journey* [61] has an achievement for players who take a full week away from the game and then return, but that achievement is disconnected from the core loop of gameplay. Free-to-play games such as *FarmVille* [71] limit the number of actions players can take in a day. Although the limited actions in these games generate opportunities to wait, the waiting itself is treated as a penalty. Players are encouraged to avoid waiting by making in-game purchases or asking social media networks for help.

Idle games signal their attitude toward waiting through game design elements. Resetting the game and starting over often grants players advantages *within gameplay* as well as marking achievements [65]. Many incremental games incorporate NG+ mechanics, which allow players to reset progress in the game in exchange for bonuses in a future playthrough. The more resets, the faster and richer future games become (e.g., [G16]). Players are also rewarded *returning bonuses* [39] when they return to the game for consecutive days (e.g., *Electric Rubber 2* [G7]). Unlike achievements, these bonuses directly affect the player's game performance.

Against Playbour

Idle games critique the notion of *playbour*, or work-like practices that emerge around gameplay [26]. Certainly idle games risk player frustration and boredom, as the central mechanic is repetitive and may induce *click fatigue* [47]. However, idle games typically give the player more rewards for doing less as the game progresses. Additionally, because play sessions can be short, the player can participate in the game during *microboredom* moments [51], in which a person is waiting for other essential daily events to take place (e.g., commuting on the train, waiting for a research paper to be typeset). Idle games enable players to fill in and leverage these moments of boredom with game interaction, but because the game continues to accumulate resources while they are idling, they are not *compelled* to play.

Never Not Playing

To engage with most digital games, players set aside time and/or space to play; this may be as elaborate as a game room with multiple monitors [13] or as simple as pulling out and engaging with a smartphone [63]. At and within both extremes, the game expressly takes attention, sometimes for extended periods of time: players need to step into the *magic circle* of the game [55]. When players switch into and out of a game activity, such as by leaving play to check their email, they are moving in and out of the magic circle. However, in idle games, idling *is* playing. As long as the game is idling in the background of their daily activity, there is no clear demarcation for when the player is playing or not. In this way, idle games temporally subvert [42] the magic circle.

Differentiating Incremental Games from Idle Games

Incremental games build on the base category of idle games by introducing *complex economies*. However, because they retain the characteristics of idle games, the player's economic decisions may play out across days, months, or years (e.g., *Kittens* [G16], *CivClicker* [G21]).

Playing at Planning

We argue that one of the central poetics of *incremental games* involves incentivizing players to play less and plan more as they progress through each game's growth curve. As the game

progresses, the player is called upon to identify priorities which manifest as short- and long-term plans. However, the player's plans must also include their physical ability to check on the game, their time and attention, and their ability to remember the plan.

Expert players paradoxically engage in fewer direct interactions with gameplay than novice players because they spend more time waiting. However, while they are devoting less tactical interaction to the experience, their play requires more strategic attention. This is often characterized by a decrease in the micromanagement behaviors that comprise the early play experience, in which the game is active for extended periods of time, accumulating resources, and the player has minimal involvement. Thus, we might say that these games produce a form of "self-obviating" play [64] in a way that challenges us to reconsider "play" and "fun", or at least relocate them outside of both the formal mechanics of the game and the dynamic player behaviors those systems entail.

Designing for Cognitive Offloading

In incremental games, waiting can be cognitively costly when returning to the game [37]. Players must remember plans between sessions, assess the game state upon return, then carry out a plan. A player is thus constantly reflecting on the game by making mental choices and reconstructing plans. To aid players, designers can provide a queuing mechanic, in which the players can add tasks to a queue for the game to perform and/or record while they are not interacting with the game (e.g., [G32]). The use of queuing mechanics represent a method to *off-load* some of the demands associated with remembering plans from the player to the game [52]. This type of game mechanic reduces the player's interaction with the game, hence playing less and shifting on the interactivity spectrum, but increases the player's power over how the game progresses.

Another design for cognitive offloading was observed in *Kittens* [G16], which provides tooltips that describe how long it will take to achieve something in physical-world time. These overlays allow the player to see which resources are needed, supporting making decisions about alternative build orders. In the game, hovering over a resource's production rate shows how long it will take the resource to reach its cap. These mechanics enable players to assess the length of waiting periods.

Implementing Games Across the Interactivity Spectrum

We found many interface design challenges associated with idle games. A large number of idle games are text-based or feature minimalist interfaces, but often lack a well-designed user interface. Many of the games we encountered were unplayable because the interface was incomprehensible and poorly documented. Some games lack helpful information for the players to make effective decisions, while others clutter the interface with unnecessary elements. Designers of idle games need to make clear and effective design choices about *what* information needs to be presented, *how* the information is displayed, and *when* it should be available to the player.

Most idle games incorporate different amounts of interactivity at different points in the game. Idle game interfaces must therefore also help players understand when new interaction is available, when interaction is welcome, and when it is more appropriate to wait.

Ludic Efficiency

One useful lens for unpacking the design of interfaces in idle games is Tanenbaum and Bizzocchi's concept of *ludic efficiency* [59]. Ludic efficiency describes the extent to which an interface eases or hinders a player's ability to achieve a desired outcome in a game: more efficient interfaces require fewer and simpler actions from the player than less efficient interfaces. In some game genres much of the core fun comes from grappling with inefficient interfaces, as is the case in fighting games, where combos and special moves are only achieved through the execution of complex button and stick movements.

For idle games we can locate them along a continuum of ludic efficiency. By this measure, zero-player games represent the height of ludic efficiency in that they literally require no actions from the player at all to be played. On the other end of the spectrum are clicker games that reward continuous and/or regular clicking to generate resources (as is the case in the first phases of *Kittens* [G16]). Even this is quite efficient when considered alongside games that fall outside of our taxonomy. While there is not a clear inflection point on the continuum of ludic efficiency that separates idle games from non-idle games, efficient interfaces are the norm within the genre.

Shifting Interaction Levels

Balancing between idle and active gameplay is important in idle games; idle games can also shift up and down the interactivity spectrum, from periods of active and regular clicking to long periods with essentially no interaction.

While many design features of idle games incentivize waiting, there are corresponding features that push players back toward clicking and other types of more active interaction. One design strategy is to make rapid clicking a special event. For example, in *Clicker Heroes* [G66], *Tiny Tappers* [G14], and *Tap Adventure* [G10], the player is periodically required to fight a boss. Winning the fight unlocks further advancements in the game. To win the boss fight, players need to make enough manual clicks in a certain time period. Because it is framed as a boss fight, the designers are treating manual clicking as an opportunity to exert personal prowess, rather than as negating the player's hard-won upgrades.

Another approach is for games to have random events (e.g., astronomical events in *Kittens Game* [G16] or golden cookies in *Cookie Clicker* [G50]). Once an event takes place, the player has a short window (a few seconds) to click and get a special reward. These events can be useful for players to speed progression in the game and keep them coming back to the game. In idle games, these events provide bonuses but do not introduce penalties. They therefore signal to the player that clicking, and the attention that goes with it, is welcome but not required.

Unlocking as Usability Support

One design approach to achieve this is for games to gradually present information and upgrades to the player as fea-

tures unlock. Micromanagement incremental games such as *Trimps* [G32] and *Kittens* [G16] present their game features and upgrades in a clean and cohesive way. These two games feature a lot of elements, upgrades, and impressive depth, which is a typical characteristic of micromanagement incremental games. However, the interface of these games gradually unfolds features to the player, allowing players to make clear decisions. Even though these features are gradually unfolded over time, the game keeps the player informed of what the next upgrades are and how to get them. Giving the player options to hide/show features and future upgrades in the game could improve usability in idle games and especially micromanagement games.

Democratized Production

As of this writing, most idle games are created by independent developers or small teams without the support of a large publisher. These games frequently have simple art and sound and require little financial support to update and maintain. The ease with which these games are produced creates a blurred line between player and developer, with some developers actively disseminating their game creation techniques for the player community to replicate [58].

We found that the lack of barriers to the creation of new idle games is not always a good thing. Many of the games we encountered were unplayable and broken, and could not be included in our data collection. There are also many "clones" within the idle game genre, where the mechanics are copied directly from another successful game (e.g., *Clicker Heroes* [G66]) with only cosmetic changes to the interface and theme. However, the ease of access also leads to a "long-tail" [11] effect for idle games, where it is possible to find niche games dedicated to a variety of player preferences ranging from deity simulators (e.g., *Godville* [G31]) to Kitten civilization simulations (e.g., *Kittens Game* [G16]).

Given this richness of game production even in the absence of idle game development tools, one might imagine what would be possible with toolkits aimed at this genre. Twine allowed the flowering of new genres of interactive fiction, including games that center queer experiences and voices [27, 30, 33]. Better tools for idle game production could allow exploration and experimentation with game *economies* in the same way that Twine allows experimentation with game *text*, and could allow new developer communities to express their economic experiences through game design.

Implications Outside Game Design

While our aim is to support designers and the games community to make sense of the idle games phenomenon, the study contributes insights into the unique characteristics of idle games and their interface design. We illuminate promising directions for future work and possible benefits of how the design of idle games could influence other applications. In the long term, we expect that idle games may serve a larger purpose in the research community, forming the basis of experiments, interventions, and game studies. Also, we expect there is value in considering not only designing them in isolation, but also as synergistic to other applications.

Gamification and Idle Games

Using elements of idle games, including mechanics and interfaces in non-game context can influence the design of gamified applications [19, 38]. The unique characteristics of idle games have the potential to be used to incentivize long-term motivation and promote desired behaviors. These idle interfaces can be designed specifically in other applications (e.g., dieting) to engage players in long-term habit change. Further research is needed to understand why players keep playing idle games, which can help designers of gamified applications to build experiences that motivate users to come back for months and years.

Long-term Planning

Owing to their often extended play times, idle games can serve as probes to understand players' planning behaviors and motivations to play games in long time scales. Further, designed games can serve as interventions to improve planning behavior [66]. By facilitating not-playing, idle games raise a number of questions about what player agency is and function as a tool to explore the edges of this space. The present taxonomy will support researchers in identifying the right game for the right study, and/or support designing new games for this purpose.

CONCLUSION

In this paper, we undertook a grounded theory study of idle games. We developed a taxonomy to point out several of the defining characteristics of these games. Further, we discuss design implications for idle games, how they affect gameplay, game mechanics and interfaces that support playing to wait, and opportunities and challenges presented by this genre.

Our taxonomy contribution aims to support designers and the games community to make sense of the idle games phenomenon and helps to understand how it may be leveraged. Designers can use the taxonomy as a guide to understand the game mechanics, types of gameplay, and design implications of each category of idle games, whether they are creating idle games or incorporating idle modes into games from other genres. Researchers can use our framework to construct studies around game design and planning mechanics; our taxonomy also provides a common language for researchers and game designers to collaborate. Finally, idle games may inspire new ways of thinking about what activities are valuable during play, how play should be organized, and what resources play demands, including both human resources, such as sustained attention, and environmental resources, such as power consumption.

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